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**FILED**

**JAN 15 2015**

**SECRETARY, BOARD OF  
OIL, GAS & MINING**

**BEFORE THE BOARD OF OIL, GAS, AND MINING  
STATE OF UTAH**

**IN THE MATTER OF THE PETITION  
OF GENWAL RESOURCES, INC., FOR  
REVIEW OF DIVISION ORDER 10-A**

**SUBMISSION OF UPDATED  
HYDROLOGIC REPORT  
DATED JANUARY 15, 2015**

Docket No. 2010-026

Cause No. C/015/0032

Genwal Resources, Inc. by and through its counsel of record hereby submits the Crandall Canyon Mine Hydrologic Update Report dated January 15, 2015, prepared by Petersen Hydrologic, attached as Exhibit A.

RESPECTFULLY SUBMITTED this 15<sup>th</sup> day of January, 2015.

BY: \_\_\_\_\_

  
ATTORNEYS FOR GENWAL RESOURCES, INC.  
Denise A. Dragoo

**CERTIFICATE OF SERVICE**

I hereby certify that the original of the foregoing **SUBMISSION OF UPDATED HYDROLOGIC REPORT DATED JANUARY 15, 2015** was hand delivered to the Board of Oil, Gas and Mining and a true and correct copy was e-mailed on January 15, 2015, to the following:

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*Sharon Bawden*

## **EXHIBIT A**



# PETERSEN HYDROLOGIC

14 January 2015

Ms. Denise Dragoo  
Snell & Wilmer, L.L.P.  
15 West South Temple, Suite 1200  
Beneficial Tower  
Salt Lake City, Utah 84101

Denise,

At your request, we have evaluated recent total iron concentrations in the Genwal Resources, Inc. Crandall Canyon Mine discharge water for the period from June 2014 to December 2014. The findings of our evaluation are presented in this letter report. The reader is referred to our previous report entitled *Investigation of Iron Concentrations in the Genwal Resources, Inc. Crandall Canyon Mine Discharge Water*, dated 7 November 2011, and also to our 10 January 2013, 11 July 2013, 16 December 2013, and 9 June 2014 update reports for additional supporting information in this regard.

## ***Results of UPDES Monitoring Activities***

Total and dissolved iron concentrations measured in both the untreated (Pre-002) and treated (UPDES 002) Crandall Canyon Mine discharge waters through December 2014 are presented in Table 1. Plots of total iron concentrations in Crandall Canyon Mine discharge waters through December 2014 are presented in Figure 1. A plot of total iron concentrations in untreated mine discharge water together with a statistical linear regression line is presented in Figure 2. A plot of dissolved iron concentrations in Crandall Canyon Mine discharge waters is presented in Figure 3. Sulfate concentrations in the untreated mine discharge water are plotted in Figure 4. Yearly average mine water discharge rates at the Crandall Canyon Mine are plotted in Figure 5. A plot of the annual

average pounds per day of iron loading to Crandall Creek from the Crandall Canyon Mine discharge is presented in Figure 6. As specified in the Mining and Reclamation Plan for the Crandall Canyon Mine, the results of all required monitoring parameters have been regularly provided to the Utah Division of Oil, Gas and Mining. Historical UPDES discharge monitoring data are available from the Division of Oil, Gas and Mining on-line coal water quality database at: <http://linux1.ogm.utah.gov/cgi-bin/appx-ogm.cgi>.

### ***Total Iron Concentration Trends***

Total iron concentration trends in the untreated Crandall Canyon Mine discharge water are shown in Table 1, Figure 1, and Figure 2. It is apparent that total iron concentrations during the period June-December 2014 in the mine discharge water generally remain low with values near the 1.24 mg/L UPDES discharge limit. It is noteworthy that the average total iron concentration measured for the four month period from June through September 2014 was the lowest measured during any of the previous 4-month periods since total iron concentration peaked in late 2009 and early 2010.

A plot of the annual average daily total iron loading to Crandall Creek is provided in Figure 6. The quantity of iron discharged to the creek is calculated using the yearly average mine water discharge rate and the yearly average total iron concentration of the mine discharge water. From this information, the average amount of total iron that is discharged daily to the creek was calculated for each of the past 5 years. It is apparent in Figure 6 that the amount of iron discharged to the creek has decreased steadily from 2010 to 2014. The calculated average daily iron loading to the creek during 2014 (6.1 pounds per day) is 3.5 times less than the amount in 2010 (21.6 pounds per day).

It is noteworthy that, because of both the decreasing total iron concentrations and the decreasing mine-water discharge rates at the Crandall Canyon Mine, the iron loading to the creek during 2013 and 2014 is less than that calculated for a UPDES compliant

discharge of 1.24 mg/L at a mine-water discharge rate of 477 gpm (the average discharge rate for year the UPDES permit was issued).

It is noted that during the last three months of 2014, total iron concentrations were somewhat greater than those of previous months (Table 1, Figure 1). An unusual, one-time upward spike in the total iron concentration (2.99 mg/L) was measured on 10 November 2014 during this period. The cause of this total iron spike has not been determined. While the spike could possibly be attributable to sampling error, there is no evidence to support that conclusion. It is possible that such a spike could be related to flushing of previously settled solid iron hydroxide particulate matter from the mine pool floor that is picked up by swiftly flowing water and transported to the mine portals during times of increased flow (above average flow rates were measured on the date of the 10 November 2014 monitoring event). Regardless of the cause of the upward concentration spike, it is apparent in Figure 1 that the magnitudes of the periodic upward spikes in the data since late 2009 have generally trended downward even as the non-spike data has also trended downward. This observation is consistent with a declining supply of available iron in the flooded underground mine environment and a gradual sweeping of the residual iron hydroxide particulates from the underground workings over time.

#### ***Other Chemical Trends***

During the period from June 2014 through December 2014 dissolved iron concentrations in the Crandall Canyon Mine pre-treatment water have remained very low – at or below the lower laboratory detection limit of 0.03 mg/L (Table 1; Figure 3). The lack of a dissolved iron component is consistent with the substantially lowered levels of pyrite oxidation in the underground mine environment. As shown on Figure 4, sulfate concentrations measured in the pre-treatment mine discharge water during this period were low and have remained relatively stable at low levels relative to the peak concentrations measured when appreciable pyrite oxidation was occurring. The declining

sulfate concentrations are consistent with substantially decreasing levels of pyrite oxidation in the underground mine environment.

#### ***Mine Water Discharge Rates***

An updated plot of average yearly mine water discharge rates from the Crandall Canyon Mine is presented as a bar graph in Figure 5. It is apparent from Figure 5 that, after peaking at 1,016 gpm in 2001, the rate of mine water discharge from the Crandall Canyon Mine has been gradually decreasing. The average mine-water discharge rate for 2014 (321 gpm) was the lowest of the previous 14 years since the mine water discharge rate exceeded 1,000 gpm during 2001. The effects of climatic variability are not apparent in the plot.

#### ***Operations at the Crandall Canyon Mine Iron Treatment Facility***

The Crandall Canyon Mine iron treatment facility operated throughout 2014. The mine-water treatment has been successful at reducing total iron concentrations to levels below the 1.24 mg/L limit of the mine's UPDES discharge permit (see Table 1 and Figure 1). However, it should be noted that on the 11 August 2014, the total iron measured in the outfall from the treatment facility at UPDES 002 was 1.32 mg/L, which fractionally exceeded the 1.24 mg/L UPDES limit for total iron. This exceedance was the result of an upset condition associated with an electrical power outage at the facility.

As total iron concentrations and mine water discharge rates continued to decline in the pre-treatment mine discharge water (Table 1), Genwal Resources personnel continued to adjust the chemical application rates at the Crandall Canyon Mine iron treatment facility during 2014. The objective of these adjustments is to achieve the necessary reduction in total iron concentrations in the post-treatment mine discharge water while using the least possible amount of chemical. By using only the lowest possible amount of chemical in the treatment facility, the release of excess chemical (that which is not consumed by the

treatment reaction) into the environment is minimized. The operating costs of the treatment facility are also reduced because of the lesser quantity of treatment chemicals required.

As the chemical application rates were adjusted during 2014, the total iron concentrations in the treated mine discharge water varied accordingly during the year (Table 1, Figure 1). While remaining below the 1.24 mg/L UPDES effluent limit, the post-treatment concentrations were generally higher than in previous years as a result of the ongoing chemical adjustments at the facility.

### ***Future Total Iron Declines***

The information presented in this update continues to support our conclusions that the observed decreasing trends in total iron concentrations are likely a result of 1) the substantially decreased rate of production of aqueous dissolved iron from pyrite oxidation reactions in the underground mine environment, and 2) the gradual flushing of solid iron hydroxide particulate matter from the mine which is transported away from source areas by the current in actively flushing portions of the mine. Based on this model, we remain confident that elevated total iron concentrations will not be perpetual and that declining concentration trends will continue into the future. Inasmuch as the recent total iron concentrations in the untreated mine discharge water are only marginally above the UPDES limit of 1.24 mg/L, it follows that the total iron concentrations in the untreated Crandall Canyon Mine water should soon fall below the 1.24 mg/L limit.

### ***Conclusions***

As stated in our previous reports and testimony before the Board, it remains my professional opinion that perpetual discharge of mine water containing elevated total iron concentrations at the Crandall Canyon Mine will not occur, and that total iron concentrations will soon drop below the 1.24 mg/L UPDES concentration limit. While



some scatter in the total iron concentration data continues to be observed, because of the overall downward trend in the total iron concentrations, and our projection that the downward trend will continue beyond the 1.24 mg/L level, total iron concentrations should decline to the point where concentrations are consistently below the UPDES limit within a reasonable period of time.

On 6 March 2012 the Utah Board of Oil, Gas and Mining (Board) found that elevated iron concentrations ( $>1.24$  mg/L) would likely not persist in the Crandall Canyon Mine discharge water for more than three years. As of the date of this report, it is apparent that the total iron concentrations have declined appreciably since that time and that total iron concentrations are near UPDES compliance levels. On two UPDES monitoring events, the total iron concentrations in the Crandall Canyon Mine discharge water were below the 1.24 mg/L UPDES limit. On a third UPDES monitoring event the total iron concentration was within the laboratory margin of error (0.05 mg/L) of the 1.24 mg/L UPDES limit. The samples of Crandall Canyon Mine discharge water collected by the Division and analyzed at the Utah State Department of Health Laboratory from March 2014 to October 2014 (the last Division sample for which information is available) range from 1.32 to 1.48 mg/L, averaging 1.38 mg/L. This average concentration is only 14 hundredths of a milligram per liter away from UPDES compliance. Considering the peak total iron concentration of 8.03 mg/L that was measured on 28 October 2009, the 1.38 mg/L represents 98% of the decline necessary to transition from the peak 8.03 mg/L to the UPDES compliant 1.24 mg/L concentration. Based on these considerations and the other information presented herein, it is my professional opinion that the total iron concentrations in the Crandall Canyon Mine discharge water will soon decline to levels below 1.24 mg/L. Genwal Resources, Inc. currently has a three-year bond in place for the future operation of the Crandall Canyon Mine treatment facility. In my professional opinion, there is a very high probability that the total iron concentration in the untreated Crandall Canyon Mine discharge water will consistently decline to levels below the 1.24 mg/L UPDES limit within this three-year period.

To verify this conclusion, Genwal Resources, Inc. will continue to collect and analyze hydrologic data relating to the Crandall Canyon Mine discharge as required.

Please feel free to contact me should you have any questions in this regard.

Sincerely,



Erik C. Petersen, P.G.  
Principal Hydrogeologist  
Utah PG #5373615-2250



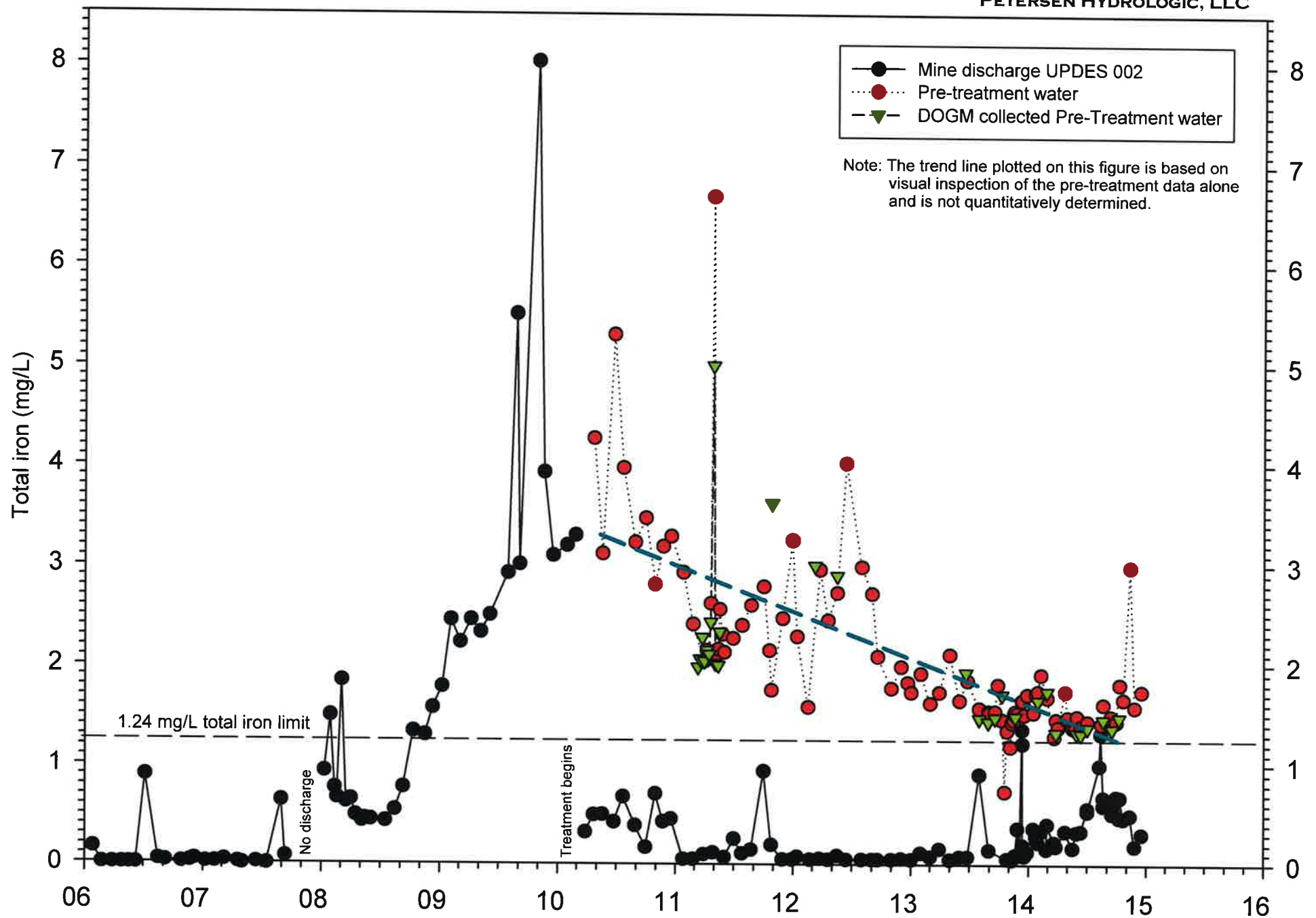


Figure 1 Plots of total iron concentrations in Crandall Canyon Mine discharge water and treated mine discharge water.

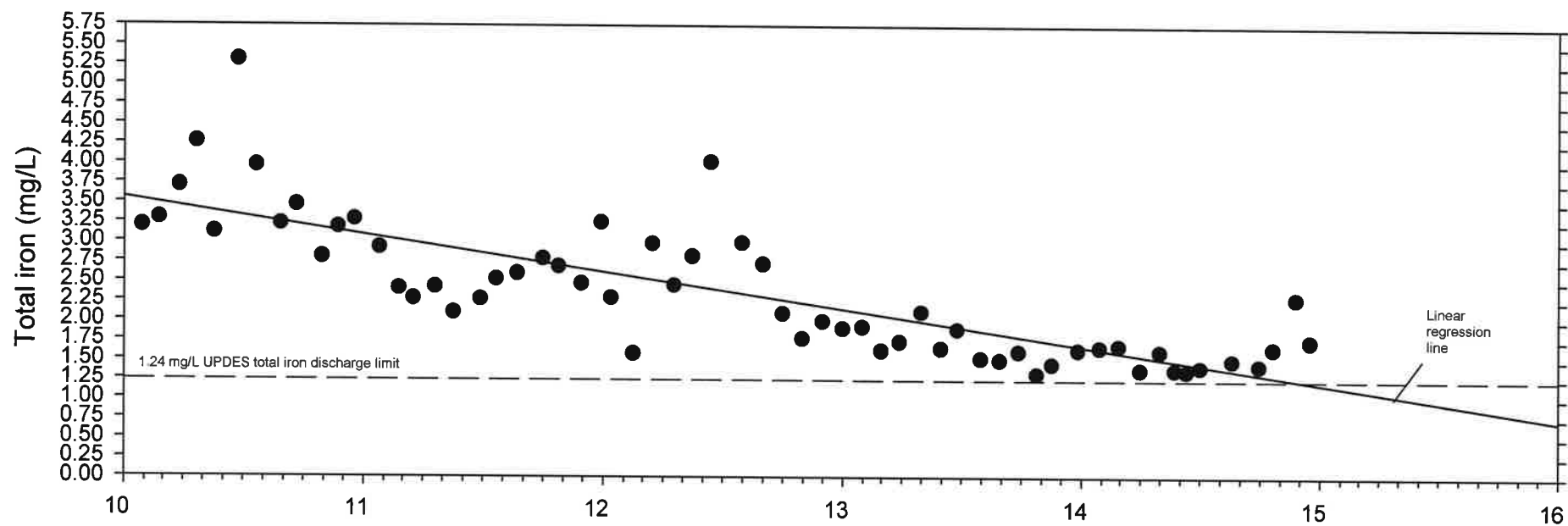
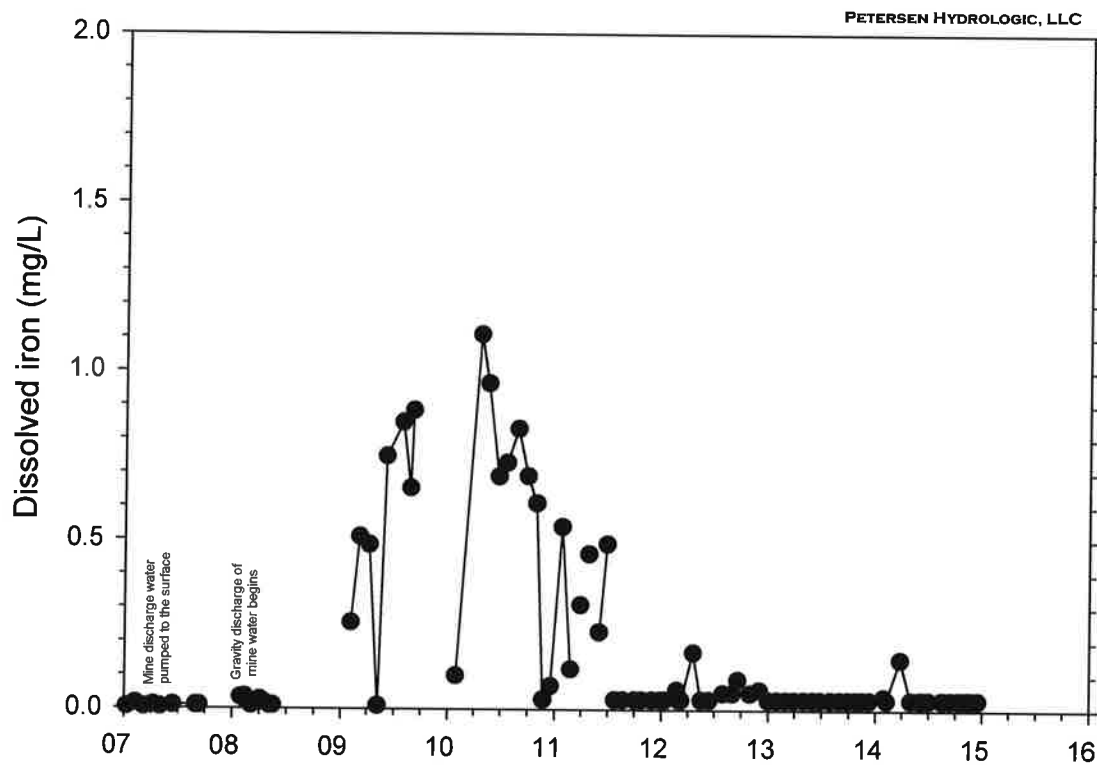


Figure 2 Plot of untreated Crandall Canyon Mine discharge water total iron concentrations (monthly averages) with linear regression line.



Note: The lower laboratory detection limits (plotted on this graph when "less than" results are reported by the analytical laboratory) have varied over time.

Figure 3 Dissolved iron concentrations in Crandall Canyon Mine pre-treatment discharge water, 2007-2014.

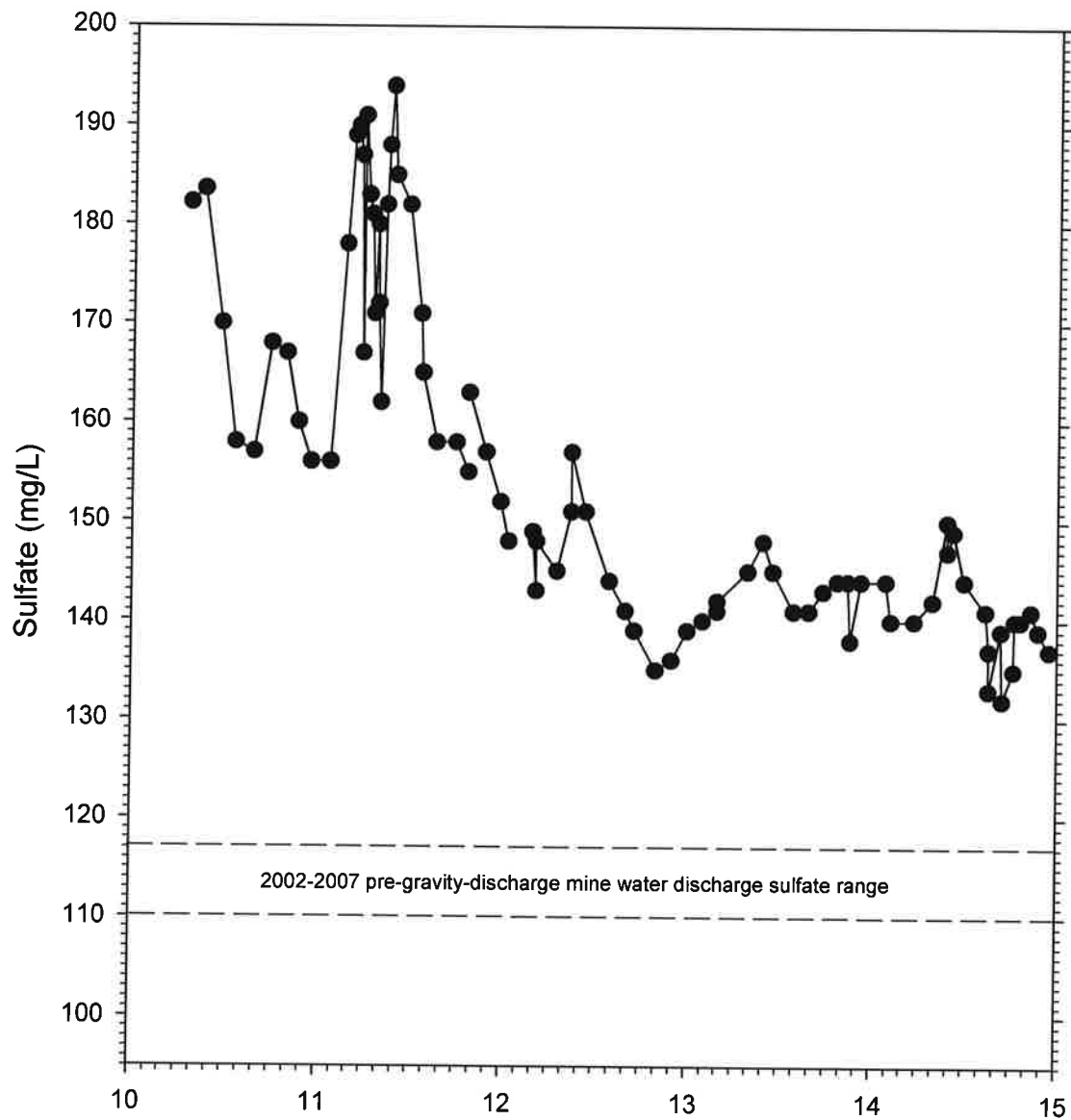
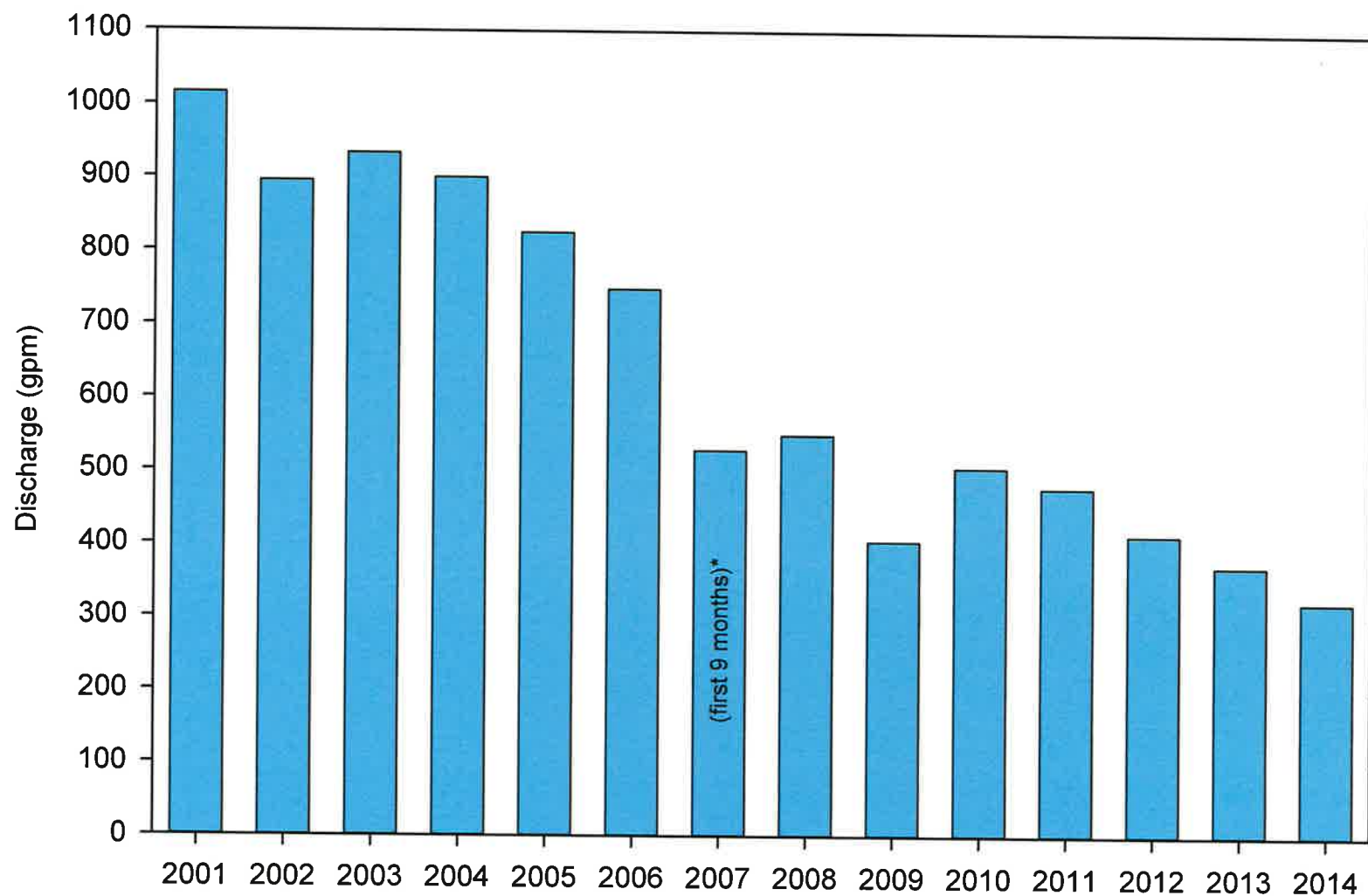


Figure 4 Sulfate concentrations in the Crandall Canyon Mine discharge water (site Pre-002).

## Crandall Canyon Mine Average yearly mine discharge rate



\*The average discharge rate for the first 9 months of 2007 is plotted because during the last 3 months of 2007 the mine pumps had been shut off but gravity discharge of mine water to the surface had not yet occurred.

Figure 5 Average yearly mine water discharge rates for the Crandall Canyon Mine.

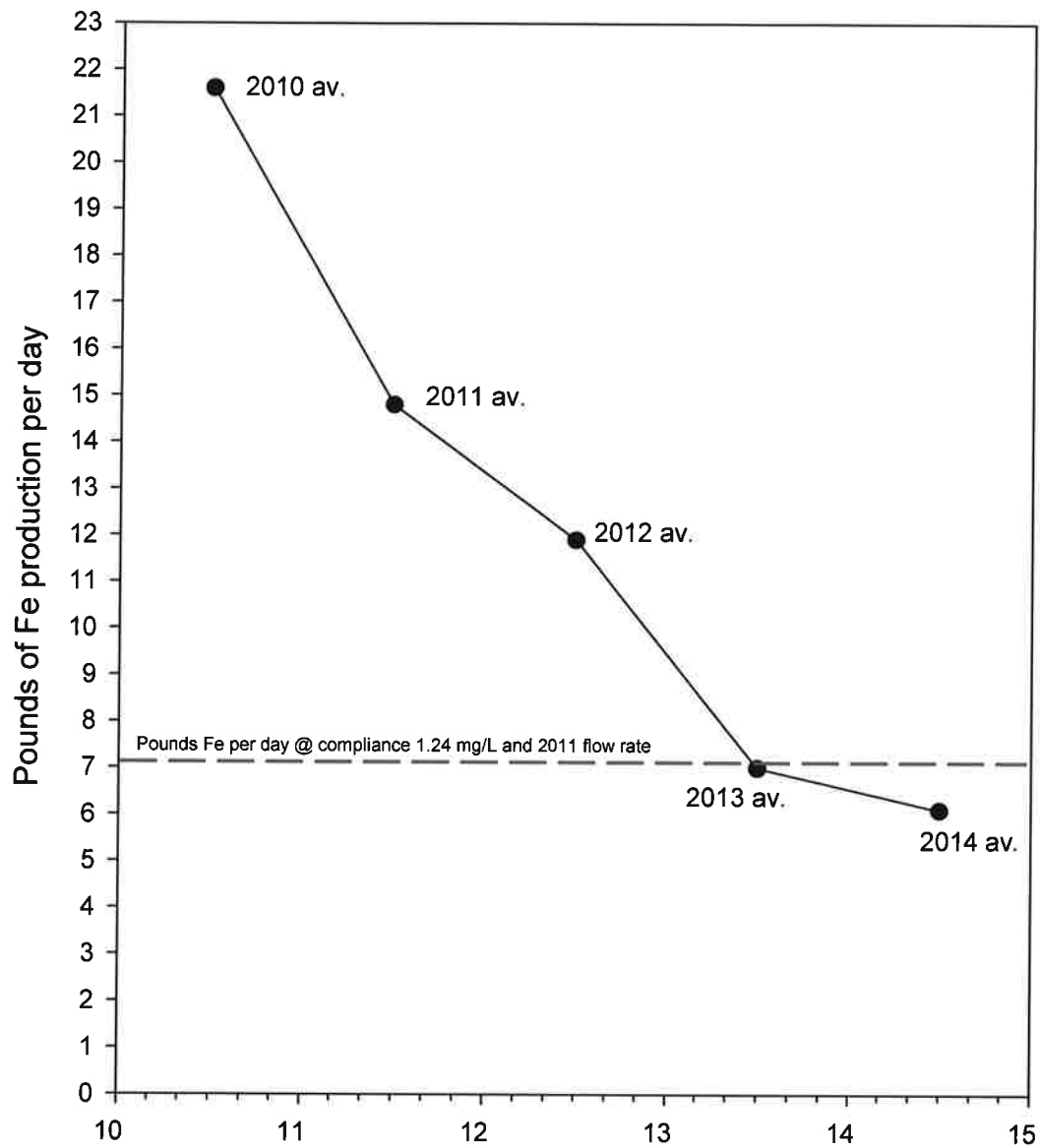


Figure 6 Daily quantity of iron produced by the Crandall Canyon Mine discharge water (calculated from annual average total iron concentration and average annual mine water discharge rate).



**Table 1 Total iron, dissolved iron, and sulfate concentrations in Crandall Canyon Mine discharge water.**

**UPDES 002**

*treated mine water discharged to Crandall Creek*

|             | Fe (total)<br>mg/L | Fe (dissolved)<br>mg/L |
|-------------|--------------------|------------------------|
| 1/29/2013   | 0.12               | <0.03                  |
| 2/28/2013   | 0.08               | <0.03                  |
| 3/28/2013   | 0.16               | <0.03                  |
| 4/30/2013   | <0.05              | <0.03                  |
| 5/30/2013   | 0.08               | <0.03                  |
| 6/19/2013*  | 1.93               | ---                    |
| 6/24/2013   | 0.08               | <0.03                  |
| 7/30/2013   | 0.91               | <0.03                  |
| 7/30/2013*  | 0.880              | ---                    |
| 8/27/2013*  | 1.090              | ---                    |
| 8/29/2013   | 0.15               | <0.03                  |
| 9/17/2013   | 0.07               | ---                    |
| 9/17/2013*  | 0.077              | ---                    |
| 9/26/2013   | 0.16               | <0.03                  |
| 10/9/2013   | 0.10               | ---                    |
| 10/17/2013  | <0.05              | ---                    |
| 10/24/2013  | 0.06               | <0.03                  |
| 11/8/2013   | <0.05              | ---                    |
| 11/14/2013  | 0.07               | <0.03                  |
| 11/16/2013  | 0.37               | ---                    |
| 11/19/2013  | 0.10               | ---                    |
| 11/26/2013  | 0.37               | ---                    |
| 12/3/2013   | 0.10               | ---                    |
| 12/10/2013  | 1.36               | 0.05                   |
| 12/10/2013* | 1.14               | ---                    |
| 12/11/2013  | 1.22               | ---                    |
| 12/12/2013  | 0.2                | ---                    |
| 12/17/2013  | 0.09               | ---                    |
| 12/26/2013  | 0.13               | ---                    |
| 1/14/2014   | 0.37               | ---                    |
| 1/22/2014   | 0.29               | ---                    |
| 1/28/2014   | 0.23               | <0.03                  |
| 1/18/2014*  | 0.21               | ---                    |
| 2/7/2014    | 0.34               | <0.03                  |
| 2/24/2014   | 0.16               | ---                    |
| 2/26/2014   | 0.41               | ---                    |
| 2/26/2014*  | 0.40               | ---                    |
| 3/20/2014   | 0.23               | ---                    |
| 3/25/2014   | 0.19               | <0.03                  |
| 3/25/2014*  | 0.17               | ---                    |
| 4/30/2014   | 0.15               | <0.03                  |
| 4/23/2014   | 0.34               | ---                    |
| 5/16/2014   | 0.17               | ---                    |
| 5/28/2014*  | 0.33               | -                      |
| 6/10/2014   | 0.34               | <0.03                  |
| 6/10/2014*  | 0.34               | -                      |
| 7/1/2014    | 0.57               | -                      |
| 7/1/2014*   | 0.54               | <0.03                  |
| 8/7/2014    | 1.00               | -                      |
| 8/11/2014   | 1.32               | <0.03                  |
| 8/19/2014   | 0.68               | <0.03                  |
| 8/19/2014*  | 0.60               | -                      |
| 9/12/2014   | 0.61               | <0.03                  |
| 9/15/2014*  | 0.52               | -                      |
| 9/29/2014   | 0.69               | -                      |
| 10/7/2014*  | 0.48               | -                      |
| 10/9/2014   | 0.68               | <0.03                  |
| 10/20/2014  | 0.47               | <0.03                  |
| 11/10/2014  | 0.50               | <0.03                  |
| 11/24/2014  | 0.19               | <0.03                  |
| 12/16/2014  | 0.31               | <0.03                  |

**PRE-002**

*untreated mine discharge water*

|             | Fe (total)<br>mg/L | Fe (dissolved)<br>mg/L | Sulfate<br>mg/L |
|-------------|--------------------|------------------------|-----------------|
| 1/29/2013   | 1.92               | <0.03                  | 140             |
| 2/28/2013   | 1.62               | <0.03                  | 141             |
| 3/28/2013   | 1.73               | <0.03                  | 142             |
| 4/30/2013   | 2.11               | <0.03                  | 145             |
| 5/30/2013   | 1.65               | <0.03                  | 148             |
| 6/19/2013*  | 1.93               | ---                    | 145             |
| 6/24/2013   | 1.85               | <0.03                  | 145             |
| 7/30/2013   | 1.57               | <0.03                  | 141             |
| 7/30/2013*  | 1.47               | ---                    | 148             |
| 8/27/2013*  | 1.44               | ---                    | 153             |
| 8/28/2013   | 1.54               | ---                    | ---             |
| 8/29/2013   | 1.52               | <0.03                  | 141             |
| 9/17/2013   | 1.54               | ---                    | ---             |
| 9/17/2013*  | 1.48               | ---                    | 135             |
| 9/26/2013   | 1.81               | 0.03                   | 143             |
| 10/9/2013   | 1.46               | ---                    | ---             |
| 10/9/2013*  | 1.71               | ---                    | 144             |
| 10/17/2013  | 0.74               | ---                    | ---             |
| 10/24/2013  | 1.35               | <0.03                  | 144             |
| 11/4/2013   | 1.19               | ---                    | ---             |
| 11/8/2013   | 1.43               | ---                    | ---             |
| 11/14/2013  | 1.46               | <0.03                  | 144             |
| 11/16/2013  | 1.52               | ---                    | ---             |
| 11/19/2013  | 1.54               | ---                    | ---             |
| 11/19/2013* | 1.49               | ---                    | 138             |
| 11/26/2013  | 1.52               | ---                    | ---             |
| 12/10/2013  | 1.65               | <0.03                  | 144             |
| 12/10/2013* | 1.48               | ---                    | ---             |
| 12/12/2013  | 1.65               | ---                    | ---             |
| 12/17/2013  | 1.51               | ---                    | ---             |
| 12/26/2013  | 1.71               | ---                    | ---             |
| 1/14/2014   | 1.53               | ---                    | ---             |
| 1/22/2014   | 1.72               | ---                    | ---             |
| 1/28/2014   | 1.74               | 0.04                   | 144             |
| 1/28/2014*  | 1.65               | ---                    | ---             |
| 2/7/2014    | 1.91               | <0.03                  | 140             |
| 2/26/2014   | 1.68               | ---                    | ---             |
| 2/26/2014*  | 1.74               | ---                    | ---             |
| 3/20/2014   | 1.29               | ---                    | ---             |
| 3/25/2014   | 1.46               | 0.15                   | 140             |
| 3/31/2014   | 1.38               | ---                    | ---             |
| 4/23/2014   | 1.74               | ---                    | ---             |
| 4/30/2014   | 1.48               | <0.03                  | 142             |
| 5/16/2014   | 1.38               | ---                    | ---             |
| 5/23/2014   | 1.37               | ---                    | ---             |
| 5/28/2014*  | 1.33               | -                      | 150             |
| 5/29/2014   | 1.49               | <0.03                  | 147             |
| 6/10/2014   | 1.39               | <0.03                  | 149             |
| 6/10/2014*  | 1.32               | -                      | 149             |
| 7/1/2014    | 1.44               | <0.03                  | 144             |
| 7/1/2014*   | 1.38               | -                      | -               |
| 8/13/2014   | 1.42               | <0.03                  | 141             |
| 8/19/2014   | 1.61               | <0.03                  | 137             |
| 8/19/2014*  | 1.46               | -                      | 133             |
| 9/12/2014   | 1.49               | <0.03                  | 139             |
| 9/15/2014*  | 1.37               | -                      | 132             |
| 9/29/2014   | 1.44               | -                      | -               |
| 10/7/2014*  | 1.48               | -                      | 135             |
| 10/9/2014   | 1.81               | <0.03                  | 140             |
| 10/20/2014  | 1.66               | <0.03                  | 140             |
| 11/10/2014  | 2.99               | <0.03                  | 141             |
| 11/24/2014  | 1.58               | 0.03                   | 139             |
| 12/16/2014  | 1.74               | <0.03                  | 137             |

\* Sample collected by the Utah Division of Oil, Gas and Mining and analyzed by Utah State Department of Health laboratory